Program 4 : Mangroves as Natural Buffers Against Tsunami and Storm Surge: How High School Students can Contribute to Mangrove Restoration

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PROGRAM 4

Mangroves as Natural Buffers Against Tsunami and Storm Surge: How High School Students can Contribute to Mangrove Restoration

Proposer Informartion		**Glenn F. Fernandez** International Environment and Disaster Management Lab Graduate School of Global Environmental Studies Kyoto University
Aims of Education/training		Knowledge, Interest, Desire, Actions
Target User	Type	Self learning, Education/training
	Direct user	Students (High school)
	Trainee/ Indirect User	Local regidents
Focus of this Information		Process Technology (PT)
Hazards		Tsunami, Cyclone/ Typhoon, Storm surge
Type of Education/training		Lecture, Field trip
Media/Material		Pamphlet
References		DRH10: "Application of Mangrove Forest for Countermeasure Against Tsunami Disaster" by Dinar Istiyanto (IOT) DRH12: "Tsunami Disaster Mitigation Technique by Coastal Greenbelt" by Tetsuya Hiraishi (IOT)

MANGROVES

as Natural Buffers against Tsunami and Storm Surge

How High School Students
Can Contribute to Mangrove Restoration

Prepared by Glenn Fernandez

What are Mangroves?

Mangroves in Bohol, Philippines

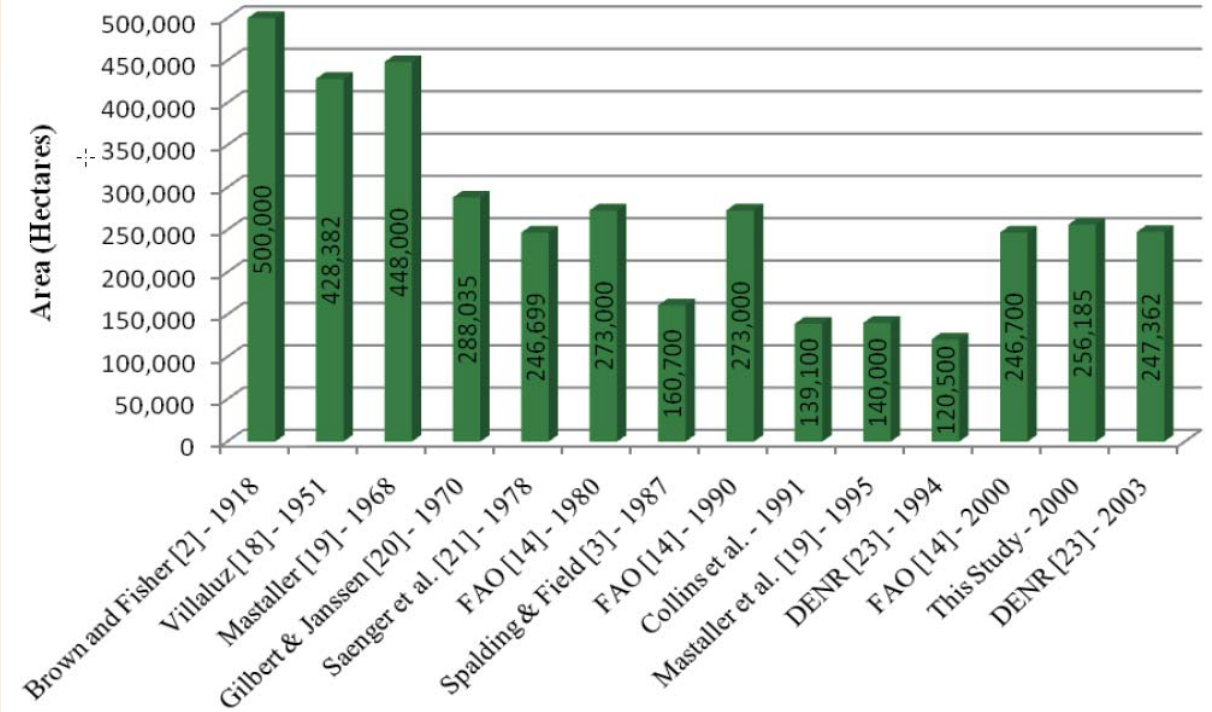
Mangroves are predominantly tropical trees and shrubs growing on sheltered coastlines, mudflats, and river banks in many parts of the world. The common characteristic all mangroves possess is tolerance to salt and brackish waters. There are around seventy known mangrove species worldwide (Field, 1999).

The mangrove ecosystem is dominated by mangrove trees as the primary producer interacting with associated aquatic fauna and physical factors of the coastal environment. The mangrove fauna is made up of shore birds, some species of mammals (e.g., monkeys, rats, etc.), reptiles, mollusks, crustaceans, fishes, and insects (Melana et al., 2000).

Mangrove forests offer numerous ecosystem goods and services to coastal populations. Most of the local communities depend on the coastal resources as major source of food and income. They are important sources of forest as well as marine products. Mangroves in particular contribute a wide array of fishery (seaweeds, fish, crabs, prawns, mollusks, and other invertebrates) and forestry (timber, firewood, tanbark for dyes, fibers and ropes, corks, etc.) products.

Mangrove amenities include coastal protection from typhoons, storm surges, and tsunami; erosion control; flood regulation; sediment trapping; nutrient recycling; and wildlife habitat and nurseries (Primavera and Esteban, 2008; Baconguis et al., 1990).

Mangroves in the Philippines



Area Estimates of Mangrove Forest in the Philippines (Source: Long and Giri, 2011)

66 out of the Philippines' 82 provinces contain mangroves, with the largest areas of mangrove forests located on the island provinces of Palawan and Sulu (Long and Giri, 2011).

Mangrove diversity is relatively high in the Philippines with 35 true mangrove species. Only Indonesia (43), Malaysia (41), Australia (37), and Papua New Guinea (37) have greater mangrove biodiversity than the Philippines (Long and Giri, 2011).

Mangroves currently occupy 0.83% of total land area of the Philippines.

More than half of the Philippines 1,500 cities and municipalities and 42,000 villages are coastal (Primavera, 2000) and stand to benefit from services derived from mangrove ecosystems.

Mangroves have suffered the earliest and greatest degradation in the Philippines because of their relative accessibility and a long history of conversion to aquaculture ponds (Primavera, 2000).

The Philippines is not in shortage of laws and policies to protect the remaining mangrove areas (Maneja, n.d.). Sustainable conservation and management relies on their strict implementation. Zoning has also been recommended for the remaining mangrove forests into Protected forest, Productive forest, Reforestation, and Conversion zones to allow for integrated coastal zone management. " Greenbelt" or buffer zone requirement of 20-50 m along riverbanks and 50-100 m facing open seas and mangrove-friendly aquaculture technology are already being promoted.

Benefits of Mangroves

Mangrove Roots Provide Shelter for Fish

Traditionally, mangroves are used for firewood, charcoal, alcohol, medicines, and thatching used for construction. They provide vital ecological services such as protection from coastal erosion, nursery and feeding sites for marine species, and possible reduction of the devastating impacts of tropical storms and tsunamis.

After tsunami, most of the coastal vegetation has been affected in the study area with shedding of leaves or browning of canopies, but mangroves tolerated the tsunami waves without showing any apparent damage. Thus mangroves are evidently the most suitable species to mitigate the effects of mighty tidal waves (Kathiresan and Rajendran, 2005).

The natural ecological and economic benefits lost with mangrove loss are significant and non-retrievable. One hectare of healthy mangrove forest supports fisheries alone worth at least US$500 per year. In addition, there are values for wood, erosion control and waste absorption that vary from site to site but are minimally worth more than the fisheries value. This means that direct economic revenues from a healthy mangrove forest covering one hectare is conservatively US$1,000.

Mangrove value may increase to more than US$10,000/hectare/year if services or regulatory functions are included (Maneja, n.d.). These may be in the form of coastal protection, erosion control, sediment stabilization, flood regulation, nutrient supply and regeneration, treatment of dissolved and particulate wastes, and habitat for wildlife.

Why Mangroves are in Danger

Mangroves Converted to Aquaculture Ponds

The mangrove forests are not exempt from disturbances and threats posed by environmental as well as human factors. The decline of Philippine mangroves from half a million hectares in 1918 to 120,000 hectares in 1994 is due to the exploitation for fuel wood and conversion to agriculture, industry, and settlements, including brackish water pond culture. Now, only 247,362 hectares (2003 estimate) of mangrove forests remain. Mangrove areas are converted into fishponds, saltponds, agriculture, and coastal projects (Primavera, 2000).

The mangrove forest resources of the Philippines have deteriorated significantly during the last 50 years. Much of the mangroves remaining is only secondary growth and by no means pristine. The culprits in the decline of mangroves are many but the primary one is conversion to aquaculture ponds and more recently conversion to urban land reclamation and other land uses. If this trend continues, there will be virtually no mangroves left in the Philippines after another 50 years (Melana et al., 2000).

Mangrove degradation in the Philippines is anticipated to continue, despite greater conservation and localized replanting efforts.

What High School Students Can do

High School Science Club Members Planting Mangroves

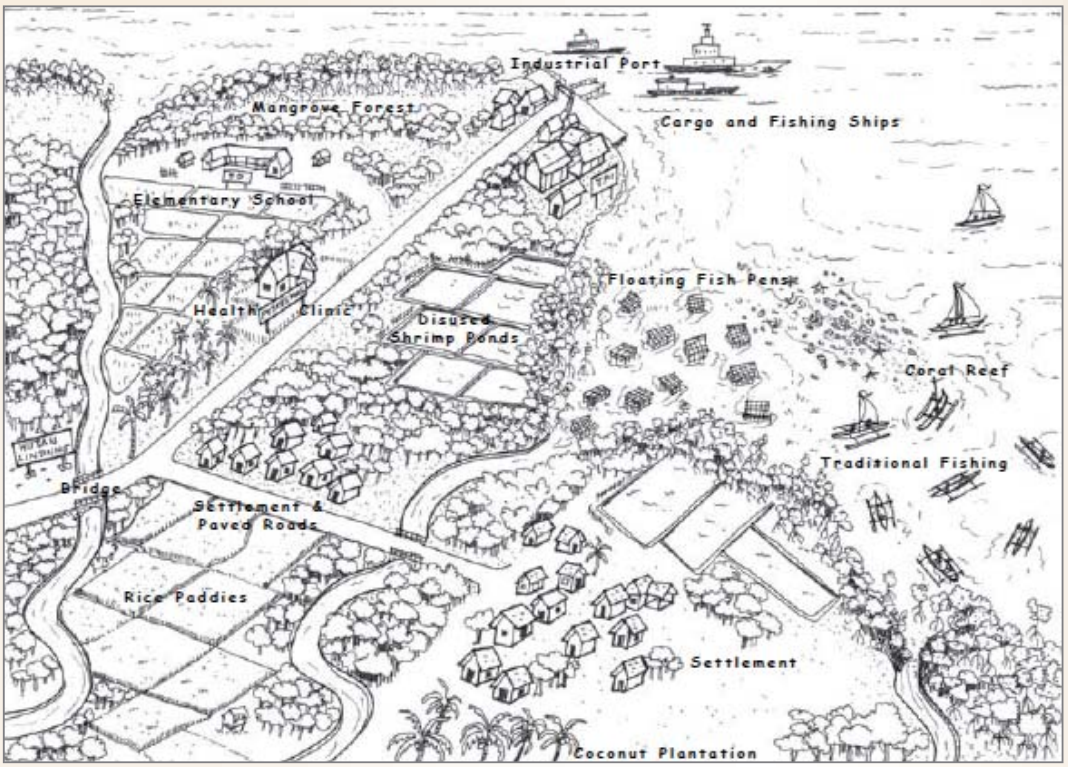
To help protect the remaining mangroves of the country and to help in reforestation efforts, high school students can contribute by:

- Learning more about mangroves in their Biology and Environmental Education lessons
- Learning about the protective function of mangroves in their Disaster Risk Reduction Education and Climate Change Education lessons
- Assisting in the initial assessment of the current condition of mangroves in their community (see Activity 1 below)
- Helping select appropriate mangrove species and reforestation sites based on available references and guidebooks (see Activity 2)
- Planning and implementing activities during the International Mangrove Action Day celebration every July 26 and during the National Disaster Consciousness Month celebration every July, linking mangrove restoration to disaster risk reduction (see Activity 3)

Most attempts to restore mangroves often fail completely, or fail to achieve the stated goals (Lewis III, 2005). Many of these failures result from afforestation attempts, which are an attempt to plant mangroves in areas that previously did not support mangroves (Primavera, n.d.).
Often mudflats in front of existing or historical stands of mangroves are proposed restoration sites. Aside from the problem of frequent flooding greater than the tolerance of mangroves, it is questionable whether the widespread attempts to convert existing natural mudflats to mangrove forests, even if they succeeded, represent ecological restoration. Students should be aware of these things before planning how to conduct Activities 1, 2, and 3.

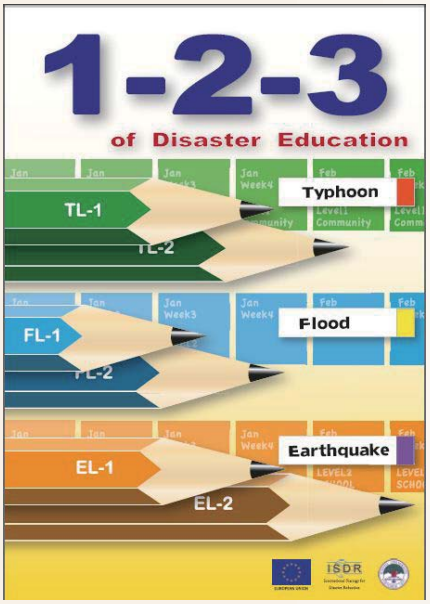
Activity 1

Initial Assessment of the Current Condition of Mangroves



Map of the Location of Mangroves in the Community

(Modified from activities TL2-E and TL2-F in "1-2-3 of Disaster Education")



Materials Needed

Base map of community; Land use map; Camera; Notebook; Paper and pens

Procedure

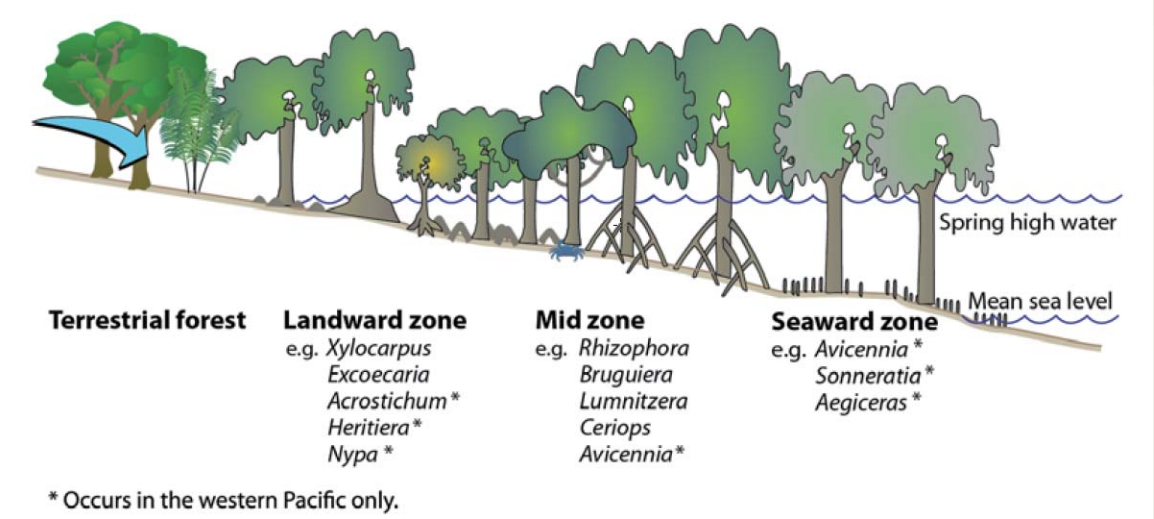
Examine the current condition of mangroves in your community by conducting an ocular inspection. Using the base map, note the location of the mangrove forests. Fill out the "Quarterly Mangrove Survey Data Collection Form" by noting the mangrove species observed in the area and their quantity and average height and taking documentary pictures. This should be done quarterly (every July, October, January, and April).

Guide Questions

Discuss with your classmates the ways of protecting existing vegetation and ways of reforesting deforested areas. Can you find any recent or even historical aerial photos of the mangroves? Has anyone ever tried to restore mangroves in your area? If so, what were their successes and failures? Were there any lessons learned from these previous efforts? (Questions posed in Brown, 2006)

Activity 2

Appropriate Species and Site Selection



Three zones of Mangrove Habitats in the Tropical Pacific (Waycott et al., 2011)

Numerous mangrove rehabilitation programs in the Philippines have failed despite enormous funding over the last few decades. The very low survival rates of mangroves can be traced to practices based mainly on the convenience of the planter rather than the ecology of the plant (Primavera, n.d.).

The first option should be to allow natural water flow (hydrology) and natural recruitment of native species. Only if there is no natural recruitment should planting seedlings from a nursery be conducted (Primavera, n.d.).

Ad hoc attempts that have been made in the past due to the lack of knowledge and experience are still common. The outcome of two decades of immense efforts to restore mangrove forests in Philippines is only 10–20% long-term survival rates at a cost of millions of dollars because of inappropriate species and site selection (Kamali and Hashim, 2011).

Students should be guided by the table below in the selection of mangrove species.

Preferred Sites and Soil Types for Mangrove Reforestation Species (DENR, n.d.)

Species	Common Name	Preferred Site	Preferred Soil Type
Avicennia alba	Bungalon puti	seaward	coralline/sandy
Avicennia marina	Bungalon	seaward	coralline/sandy
Avicennia officinalis	Api-api	landward	silty loam to clay loam
Bruguiera gymnorrhiza	Busaing	landward/riverine	silty loam to clay loam
Bruguiera sexangula	Pototan	landward	silty loam to clay loam
Bruguiera parviflora	Langarai	landward	silty to silty loam
Ceriops tagal	Tangal	landward	silty to clay
Nypa fruticans	Nipa	river fringes	silty to silty clay/brackish
Rhizophora apiculata	Bakauan lalake	middleward	sandy loam/silty
Rhizophora mucronata	Bakauan babae	middleward/riverine/seaward	silty clay
Rhizophora stylosa	Bangkaw	seaward	coralline/sandy/rocky
Sonneratia alba	Pagatpat	seaward	

Activity 3

Celebrating International Mangrove Action Day (July 26) and National Disaster Consciousness Month (July)

Map of the Location of Mangroves in the Community

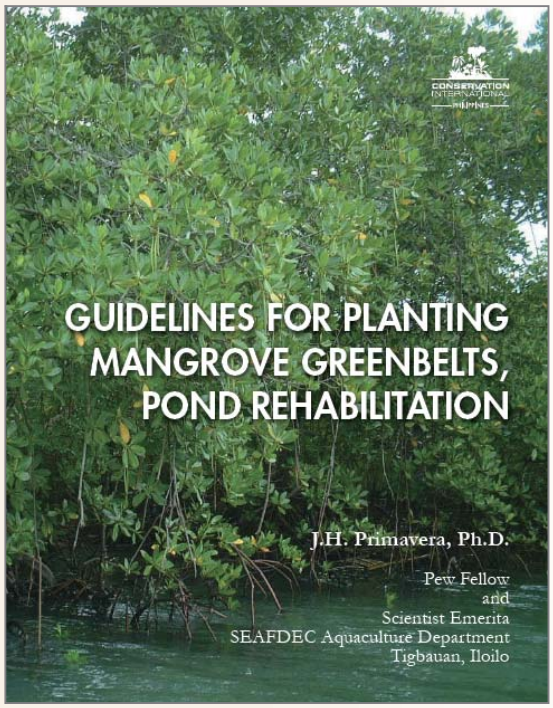
July 26th has been called the "Day of the Mangrove," commemorating that day in 1998 when a Greenpeace activist from Micronesia, Hayhow Daniel Nanoto, died of a heart attack while involved in a massive protest action against illegally placed shrimp ponds. Since Hayhow's death, environmentalists have commemorated this day as a day to remember and to take renewed action to save the mangroves (taken from the World Rainforest Movement website, http://www.wrm.org.uy).

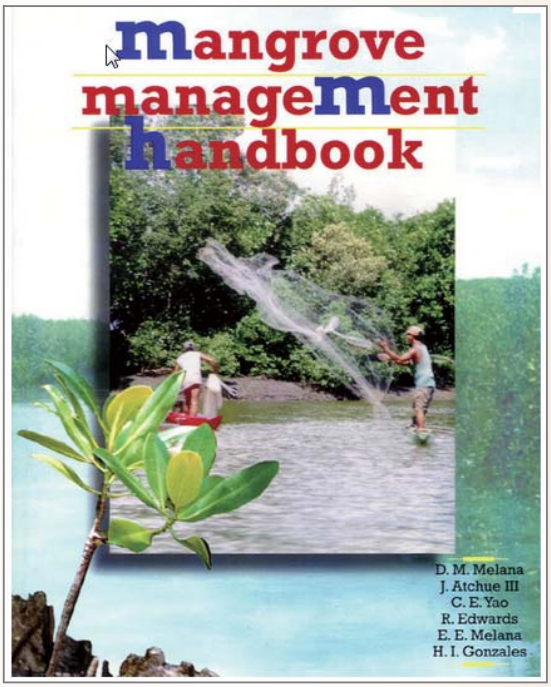
On the other hand, the month of July is designated as the National Disaster Consciousness Month (NDCM) in the Philippines, in accordance with Executive Order No. 137 dated August 10, 1999.

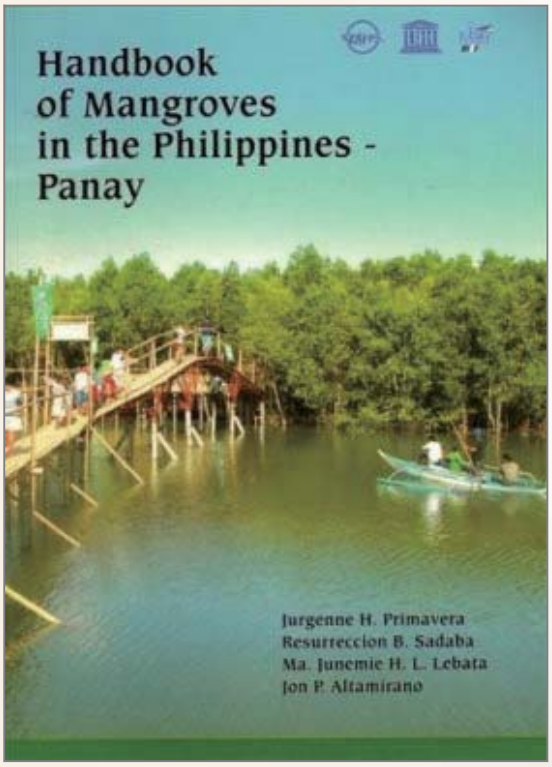
High school students can join the celebration of these two important occasions by planning and implementing their own activities, which can include adopting and protecting a patch of existing mangrove forest; reforesting a denuded patch of mangrove forest; documenting and reporting the conditions of mangroves; holding an awareness campaign on the role of mangroves as natural buffer against natural hazards like tsunami, typhoons, storm surge, strong winds, coastal erosion, etc. Support for the mangroves from various stakeholders, including young people, will make the difference.

References for Mangrove Restoration

High school students should peruse the following handbooks and guides in their reforestation efforts to avoid the failures met in past initiatives. Other useful reference materials are listed in the Bibliography.







Bibliography

Pre-Activity

- Hiraishi, Tetsuya. 2010. "Tsunami Disaster Mitigation Technique by Coastal Greenbelt (DRH 12)." Available at http://drh.edm.bosai.go.jp/
- Istiyanto, Dinar. 2010. "Application of Mangrove Forest for Countermeasure Against Tsunami Disaster (DRH 10)." Available at http://drh.edm.bosai.go.jp/
- Primavera, Jurgenne H., and J.M.A. Esteban. 2008. "A Review of Mangrove Rehabilitation in the Philippines: Successes, Failures and Future Prospects." Wetlands Ecol Manage. doi:10.1007/s11273-008-9101-y. http://www.mangroverestoration.com/pdfs/Primavera%20and%20Esteban%202008.pdf.

Activity 1

- Brown, Ben. 2004. Do Your Own Mangrove Action Project. Mangrove Action Project. http://mangroveactionproject.org/files/education/do-your-own-map/Do%20Your%20Own%20MAP%20%20(eng-72dpi).pdf.
- Brown, Ben. 2006. Five Steps to Successful Ecological Restoration of Mangroves. Yogyakarta, Indonesia: Mangrove Action Project. http://www.mangroverestoration.com/pdfs/mangrove_restoration.pdf.
- Tan, Kim Hooi. 2007. "Mangrove Plant Diversity in Southeast and East Asia" presented at the UNEP/GEF SCS Project Training Course on Sustainable Mangrove Management, Penang, Malaysia. http://www.unepscs.org/Mangrove-Training/05-Mangrove-Plant-Diversity-South-China-Sea.pdf.

Activity 2

- DENR (Department of Environment and Natural Resources). No date. "Guidelines for Community-based Rehabilitation of Mangroves." http://erdb.denr.gov.ph/publications/denr/denr_v5.pdf.
- Melana, Dioscoro, Joseph III Atchue, Calixto Yao, Randy Edwards, Emma Melana, and Homer Gonzales. 2000. Mangrove Management Handbook. Manila, Philippines: Department of Environment and Natural Resources. http://pdf.usaid.gov/pdf_docs/PNACM045.pdf.
- Primavera, Jurgenne H. No date. Guidelines for Planting Mangrove Greenbelts, Pond Rehabilitation. Conservation International. http://www.conservation.org/act/spread_the_word/Pages/pledge-to-protect-the-planet-that-provides.aspx.

A complete list of references can be obtained by writing to:
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Page 2: Wikimedia Commons
Page 3: Long and Giri, 2011
Page 4: http://www.reefed.edu.au
Page 5: http://www.article.wn.com
Page 6: Philippine Society of Youth Science Clubs
Page 7: Brown, 2004 (http://mangroveactionproject.org)
Page 8: Waycott et al., 2011
Page 9: Brown, 2004 (http://mangroveactionproject.org)
Page 12: http://plantsareinteresting.blogspot.jp/

Quarterly Mangrove Survey Data Collection Form

Date	July 26	October __	January __	April __
Location	Barangay Alitas, Infanta Municipality, Quezon Province			
Area (sq km)	2			
Team Members	Glenn Fernandez, Lenee Uy, Nicolle Comafay, Gennie Ramos, Jeff Perez, Jun Tiburan			

Species Name / Local Name	Long-shot Picture	Close-up Picture	Number of Trees	Average Height (m)
EXAMPLE Avicennia alba bungalon, api-api			~200	2

NOTES:

- This mangrove species dominate the total mangrove population in this area.
- Propagules might be ready for collection in two weeks.
- Around 500 propagules can be turned over to the mangrove nursery.
- The area is already densely populated by mangroves. Reforestation is not necessary anymore.
- Regular monitoring is needed as there are a few mangrove trees that were evidently cut just a few days earlier, judging from the leaves that were still green. Cutting mangroves for charcoal is still being practiced in the area.

<Note>